```
**************************************************************
*                                                            *
*          QQQQQQQ        ZZZZZZZZZ      XX      XX         *
*        QQQQQQQQQQ       ZZZZZZZZ        XX    XX          *
*        QQ      QQ             ZZ         XX XX            *
*        QQ      QQ            ZZ           XXX             *
*        QQ      QQ           ZZ            XXX             *
*        QQ    QQ QQ         ZZ             XX XX           *
*        QQQQQQQQQQ         ZZZZZZZZ       XX   XX         *
*          QQQQQQQQ         ZZZZZZZZZ     XX     XX        *
*                QQ                                          *
*                                                            *
**************************************************************
```

The Journal Covering Amateur Radio & Sinclair Computers
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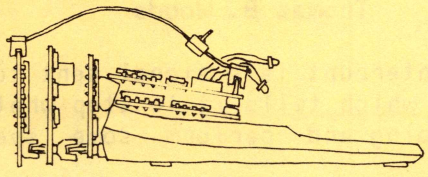
*Pseudoscope for TS2068--A serial bit stream analyzer which mimics the action of an oscilloscope. Use to graphically portray low frequency digital signals in a horizontally scrolling graph. Program lets you store and compare samples. Print them out on a 2040 printer. Adjustable sample rate, 60hz timing dots are plotted with your input sample. Pseudoscope lets you SEE morse, rtty, serial keyboard signals, etc. as the computer sees them. Very useful in program development or in optimizing interface hardware. Tape/instruction book/full disassembly: $16.95

*Computer I/O Data Communications--Lets your 2068 speak to your ZX81! Use your TS1000 (must have 64K ram) to store data for your 2068. Send commands which transfer data back and forth, or cause the TS1000 to execute your own special Basic commands. Now 2068 owners can put their old 1000's back on line. Software includes operating systems for both computers. Requires 2 port boards (one for each computer). Tape/instructions: $16.95.



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********** Software & Hardware for TIMEX·SINCLAIR **********

SyncWare News
Reviewed by Alex. F. Burr K5XY

SyncWare News is now a book as well as a technically oriented magazine. In this well produced 110 page book you will find one of the best reprint books produced. In here is all the information contained in Volume 1 of SyncWare News printed from June 1983 to June 1984. All the articles have been completely reset and grouped in well organized categories. Furthermore, a modest amount of updating has been done and some background articles added.

The entire book was written on ZX81's. But do not worry about the readability. It was printed out by a C. Itoh Starwriter F-10 daisywheel printer through a Memotech interface unit. The type is clear, dark, and very readable, partly because a little extra space was left between the lines. The letters are well formed, a bit smaller than usual, and proportionally spaced so a lot of words are put on one page. The circuit diagrams were redrawn and somewhat enlarged so they are easy to read too.

The book contains a well balanced mixture of hardware projects, software instructions, and helpful hints. The articles will appeal to the technically minded reader who wants to know why something is done. The sections I found particularly interesting included a section on TV operation and monitor hook-up, cassette recording information, battery back-up, and printer connections, although there is a lot of good information on other subjects too. Most of the information presented is for the ZX-81 or T/S 1500.

The TV section gave some details of the typical TV signal and how it works in the receiver to help one understand how the T/S computers produce their screen outputs. Also included are instructions on how to hook up a monitor and a project on obtaining reverse video. The cassette recording section included details of the signals to be recorded and hardware articles on cassette recorder interfaces. The battery back-up section included six schematics for different aspects of these projects.

The last 25 pages are devoted to applications of these little computers to large mathematical problems like simultaneous equations, integration, and differentiation. The examples for the simultaneous equation section were taken from a study of the Wheatstone Bridge so there is a lot for the electronic types even in this math section. The book is a bit difficult for complete beginners, but all others will find the book well worth its price. It is just full of information and interesting ideas, many not found elsewhere.

SyncWare News, Box 64, Jefferson, NH 03583; 112p $16.95.

POST USE QL REVIEW
Cliff Efaw K7HSX

Here are some of my impressions after some use of the QL.

The only key I have had trouble with is the ENTER key which is reversed L shaped. If it is not hit at the corner of the L it will not work. The keyboard is better than the 2068 but not as good as a manual typewriter. There should be some way to tell when it is in the capital mode.

So far I haven't had much trouble with the microdrives. I had two commercial cartridges that wouldn't load properly. I had to return them.

There was no problem with the directory system or file loading except on the defective cartridges.

The display on a color TV was fair. It probably would be better on a PAL system which has higher resolution than US TV does. I should adjust the width on my TV because the right hand edge of the printer matter is even with the mask. Someday I will try a monitor.

I have no benchmark programs for the QL yet to see how it compares with other Sinclair computers. The only program that I have to compare with is CHESS on the ZX81 and QL CHESS. QL CHESS loads in about 45 seconds while the ZX took five minutes or more to load. QL plays a faster game too.

So far I like the QL but have a lot more to learn about how it works and how to program in SUPERBASIC. The programs that come with the QL are ample for my use.

(Publisher's Note: For more comments on SUPERBASIC see January 1985 QZX and for comments on the keyboard see Publisher's notes in the July 1985 issue).

INTERRUPTS
Thomas B. Woods

An interrupt is a signal sent to the computer which tells it to stop whatever it is doing and perform some special

task. In other words, an interrupt signal does just what its name implies: it interrupts the computer's normal program execution and causes the machine to execute a special interrupt handler program instead. This interrupt handler would normally be a subroutine designed to take care of some special task whenever an interrupt occurs. When this subroutine is finished, normal program execution would pick up right where it left off when the interrupt first occurred.

There are three different kinds of interrupts. They are the Bus Request, the Non-Maskable Interrupt, and the Maskable Interrupt. It is the maskable variety that interests us here. Maskable interrupts differ from the first two kinds in that they can be masked. This means that the computer can be made to ignore them if desired. Two machine code commands, EI and DI (Enable Interrupts and Disable Interrupts) serve as switches which turn the interrupt handling on or off. After the EI command is executed, any maskable interrupt signal sent to the Z80 microprocessor will cause the normal program execution to stop temporarily while the interrupt service routine is called. If a DI instruction is executed, the computer will ignore any maskable interrupts. Programs execute as if the interrupt never occurred.

Interrupts have many uses. They can warn the system of eminent power failures, trigger the computer to read an input port at a critical instant in time, form the basis of an independent real time clock, etc. The T/S2068 uses interrupts as its keyboard read routine. Internal hardware generates an interrupt signal 60 times a second. Every time a signal occurs, the 2068 stops to see if you're pressing a key.

The question now arises, when an interrupt occurs, where exactly does the computer go to find the proper interrupt handler program? Or put a bit differently, how can you the programmer have any say in where the computer jumps when the interrupt occurs? This is where "interrupt modes" become important. The Z80 has three different ways of handling maskable interrupts. Which method (or mode) it uses is determined by the program being run. There are three machine code commands (IM0, IM1, and IM2) which can be included in a program to set the interrupt mode you wish to use. Each mode has its advantages and disadvantages.

In interrupt mode 0 (IM0) when a maskable interrupt occurs, the computer stops and waits for one instruction to be placed on the data bus by the device which caused the interrupt. A typical instruction would be a CALL or RST to a subroutine, however JP's can also be used. This mode is not used on the T/S2068.

Interrupt mode 1 (IM1) is the normal 2068 mode and also the simplest. In this mode, and interrupt signal causes the computer to automatically perform a RST 38 instruction. In other words, call the subroutine beginning at address 0038 hex. I mentioned previously that keyboard scanning is performed via interrupts on the 2068; Therefore, if you were to look at the 2068 ROM, you would find the key scanning routine starting at address 0038.

The third interrupt mode (IM2) is the most versatile mode; but, unfortunately, also the most difficult to implement. In this mode, the device causing the interrupt places a number on the data bus just like in mode 0. Mode 2, however, uses this number as the low half of a 16 bit address. It takes the high half from the special "I" register. After resetting bit zero of this "vector address" to zero, the computer then treats this number as an entry on a jump table. Whatever value is found at the two bytes starting at the address formed by the vector will be the address the computer will call to handle the interrupt.

In this way, you could have a total of 128 different subroutines to service the interrupt. You could have just one "intelligent" device specify the proper routine by having it send the interrupt and the low half of the desired vector which points to the proper service address. Or, you could have as many as 128 different devices each interrupting the computer, and each with its own unique service routine. This is all accomplished by having the device which causes the interrupt to also supply the lower 8 bits of the desired address in the jump table. It isn't absolutely necessary to have a hardware device supply the low half of the vector address. On the ZX Spectrum. pull-up resistors on the 8 data lines insure that there will always be the number FF hex on the data bus when a maskable interrupt causes a vector to be formed. This means that you can always count on the fact that the interrupt table will always be

located at the address xxFE where "xx" is the value found in the I register. Therefore, if you preset the I register with the value of FB hex, and at address FBFE you place the address of your service routine, you could put the computer into mode 2 and have the internally generated interrupts cause the machine to jump to your own code. That works for the Spectrum.

There are problems which crop up when you try to use IM2 on the 2068. Namely, there are no pull-up resistors on the 2068 data bus. Without them, you have no way of knowing what number will be there when a vector is being formed by IM2. On the T/S2068, you can set the I register to FB, just like it was noted above for the Spectrum; but, since the data bus which forms the low half of the vector could be just about anything, you just don't know where to put the service routine address. It could be anywhere from FB00 to FBFF. There is a sneaky way to get around this, however. That is to put the address of your interrupt handler everywhere within the range of the vector table. In other words, fill the entire space from FB00 to FBFF with the same number. When an interrupt occurs, even though you don't know exactly where in the table the handler will be chosen, you will have covered all the bases by insuring that the same service routine address will be found everywhere.

(Publisher's Note: This and more machine code information is contained in the Operator's and Programmer's Reference Manual for the Pseudoscope, a serial bit stream analyzer for the T/S2068 and the Experimentor's Universal Input/Output Port. More information about these items can be found in the ad in this issue.)

Active Filter Design
Tom Winternitz - W2MS

Elsewhere in this issue is an interesting active filter design program that displays the circuit as well.

Editor's Doings - W4GHV

Packet radio continues to be 'the thing', with progress being made on construction of some Pac-Comm TNC-2's. (described in December QZX). I'm off to Tucson in February for the annual meeting of the Tucson Amateur Packet Radio Corp. to learn what I can about packet radio. We will hopefully provide tutorial articles on this fascinating mode of communications as well as complete info on how to use your Timex/Sinclair with a TNC-2. Keep your eyes peeled for an economical RS-232 interface if you don't already have one. I haven't found a reasonably priced one yet. The homemade approach, following Vic Rice's article that appeared in CTM magazine looks like the best way to go. Needed along with it will be 'fancy' terminal programs to communicate with the TNC-2. Send in your ideas & accomplishments!

Those of you that have the luxury of an IBM-compatible MS-DOS computer as well, may be interested in a new RTTY public domain program I recently received from KF4NB. It is available on Teachers Pet Fido bulletin board (505-646-5194). It's BIG, so 1200 baud is essential to download this one. You can of course access Fido at 300 baud which contains an assortment of MS-DOS, Commodore, Sanyo, & Tandy programs, free for the asking. Alex & I transfer QZX articles & info on Fido as well. A few QZX readers have checked in to say 'howdy'.

TS1000 Console Using the TI Keyboard
LU8MAD

Received from Guillermo was a nice set of drawings on how he constructed a nice console for his TS1000 & the TI surplus keyboard. If interested in 'bending some metal', send us a business size SASE.

QZX FRIENDS

WA4BQE -- Edward sent us an unclassified ad and the welcome news that he might visit us in person in March.

W9CQD -- Russ sent in his net report typed with WORD* on his ZX81. He is looking for a FIDO net node nearby so he can sent it in by computer (see November QZX).

KC9EZ -- Danny renewed and requested more 1000 and 1500 articles. He uses his with the NU4V RTTY and CW programs. One has an 83 key keyboard added to it.

K7HSX -- Cliff said "Please renew my subscription. Sorry I am late as I have been playing around with ny new QL. ZX-81, T/S1000 and 2068 are headed for disposal. Too awkward shifting back and forth."

WD4PPM -- Bobby says that he is currently using a ZX-81, two T/S 1000's, and a T/S 2068 with an old ZX-80 in the

closet. He uses the ZX-81 for morse code only and is working on RTTY with the T/S 1000 and NU4V's RT-1A, NRTU, and software. The T/S 2068 and a lot of Byte-Back hardware is used for playing.

BITS AND BYTES

61. A SAVE hint for the T/S 2068. To replace the message "Start tape then press Enter" you just need to POKE 26689,38. Consider the following example.

```
10 PRINT #0; "READY TO SAVE"'"START THE TAPE"'"NOW PRESS ENTER"
20 POKE 26689,38:SAVE "DEMO"
```

The last half of line 20 just saves this demo program and would not be used to change the wording. In line 10 of course you can use any wording that you wish.

62. Another SAVE hint for those with the Spectrum ROM. If you POKE 23736, 181 the computer starts SAVEing at once without waiting for a key press.

63. K6EEU writes that there is an error in the Sam's book (reviewed in November 1984 QZX), Timex Sinclair 2068 Intermediate/Advanced Guide, by Jeff Mazur. Fig. 6-3 on page 107 is correct, but Table 6-3 on pages 109 to 112 is in error. Looking at the pin column change all A's to B's and all B's to A's.

64. To get out of an infinite input loop without crashing your T/S 2068 try typing USR 15002.

65. The following short program will allow you to change paper and ink color on the T/S 2068 without clearing the screen.

```
DIM A$(704)
PRINT AT 0,0; OVER 1;
PAPER 1; INK 6; A$
```

66. If you have difficulty loading some T/S 2068 programs it will sometimes help to type

```
LOAD ""CODE
RAND USR 33792
```

67. To reset the T/S 2068 type

```
RANDOMIZE USR 0
```

68. On the T/S 2068 to send all the data normally destined for the screen to the printer type

```
OPEN #2, "p"
```

To cancel the above command type

```
CLOSE #2
```

69. To get a ? as a cursor in input statements on the T/S 2068 type POKE 23617,236

70. A reset hint for the T/S 1000 types from Everett Smoot. A cheap and easy reset switch can be installed by taking a mercury switch such as the Radio Shack 275-027, bend the leads and solder them across the reset capacitor so that the switch is off in the normal position. Then tilt the computer to reset it.

UNCLASSIFIED ADS

WANTED: UNCLASSIFIED ADS for publication in QZX. Cost is 1 cent for each keystroke (characters, blanks, etc.). Payment must be included with order. This is an excellent way to sell your program or unwanted equipment, ask for help, or find a specific program. Send your ad with payment to QZX, 2025 O'Donnell, Las Cruces, NM 88001.

FOR SALE: Timex Sinclair 2040 personal printer paper for 4 roll packs by Labelon for $2.00, please include $2.00 for UPS shipping. Send to Dale Johnson WB9NRK, 1331 Bellevue Lot 371, Green Bay, Wis. 54302.

WANTED: Schematics for Printer Model 2040 and Memotech Memopak I/F Centronic type parallel printer interface. E. Radtke - 1602 Woodluck Ave, Louisville, KY 40205.

WANTED: 1984 QZX months 1-7&10, 1983 Feb & Mar. Fred Gunther K7FG, 1402 W. Craig, Moses Lake, WA 98837.

FOR SALE: New T/S 1000, 16 K RAM, digital clock, pwr supply mounted in Radio Shack cabinet, plug-in keyboard with keys marked with Mule decals in Timex format, instruction book, new CWSS program on cassette, CW-1 I/O interface nearly completed with components, spare T/S 1000 and 16 K RAM, 12 QZX, all $50.00 Prepaid. New TAB computer books and other authors. Cost about $40.00 for $15.00 prepaid. KD7EC, RR 1 Box 12D, Safford, AZ 85546.

ACTIVE FILTER DESIGN - HIGH, LOW & BAND PASS

By Tom Wintermitz W2MS Box 73 Merry Point VA 22513

```
  4 LET II=0
  5 DIM G(30): DIM A(6): DIM B(6): DIM C(9): DIM D(9)
 14 PRINT  AT 5,0;"SELECT LOW PASS(LP), HIGH PASS   (HP) OR BAND PASS(BP) FILTE
R  "
 15 INPUT O$
 16 CLS
 18 IF O$="LP" THEN  GO SUB 500
 19 IF O$="HP" THEN  GO SUB 600
 20 IF O$="BP" THEN  GO SUB 700
 21 PRINT  AT 21,0;"PRESS ENTER"
 22 INPUT P$
 23 GO SUB 400
 25 PRINT : PRINT
 28 IF O$="HP" THEN  PRINT "ENTER INPUT CAPACITOR (C2)        -MICROFARADS - ";
 30 IF O$ <> "HP" THEN  PRINT "ENTER FEEDBACK CAPACITOR (C2)   -MICROFARADS - "

 31 INPUT C2
 32 PRINT C2
 35 LET C2=C2/(10^6)
 40 IF O$="LP" THEN  GO SUB 1000
 41 IF O$="HP" THEN  GO SUB 2000
 42 IF O$="BP" THEN  GO SUB 3000
 45  STOP
 50 PRINT "FOR A NEW DESIGN, PRESS ""RUN"""
 52 STOP
400 REM  SETUP
401 CLS
402 PRINT
405 PRINT "GAIN SHOULD BE BELOW 10 FOR BEST RESULTS - ENTER GAIN -
407 INPUT H
410 PRINT H
411 PRINT
412 IF O$="BP" THEN  PRINT "ENTER CENTER FREQUENCY -(FC)       -HZ.  ";
414 IF O$ <> "BP" THEN  PRINT "ENTER CUT-OFF FREQUENCY (FC)    - HZ.  ";
416 INPUT FC
417 PRINT FC
418 CLS
419 PRINT
420 IF O$ <> "BP" THEN  PRINT "  -NOTE- Z SHOULD BE .707 FOR    BUTTERWORTH  OR
MAXIMALLY FLAT FILTER"
422 IF O$="BP" THEN  PRINT "  -NOTE- FOR BP FILTER IF Q  >= 1   RESPONSE WILL B
 PLOTTED IN RELATIVE FREQUENCY": PRINT "NOTE- ""Q"" MUST NOT BE > 50R OF GAIN (
)"
423 PRINT
424 IF O$ <> "BP" THEN  PRINT "ENTER DAMPING COEF. (Z)   ";
425 IF O$="BP" THEN  PRINT "ENTER   ""Q""  FOR BP FILTER  - "
426 INPUT Q
427 PRINT Q
430 RETURN
450 REM PRINT VALUES
452 PRINT  AT 14,15;"R1=": INT (100*R1)/100;" OHMS"
454 PRINT  AT 15,15;"R2=": INT (100*R2)/100;" OHMS"
456 PRINT  AT 17,15;"C1=";C1;" MF"
458 PRINT  AT 18,15;"C2=";C2 ;" MF"
460 RETURN
470 REM  REVALUE C2
474 PRINT  AT 20,0;"TO REDO VALUES TYPE (Y)         FOR RESPONSE, PRESS ""ENTER
""
475 INPUT Y$
476 CLS
478 IF  CODE Y$=89 THEN  GO TO 28
480 IF O$="BP" THEN  PRINT "WAIT ONE"
485 RETURN
```

```
500 PRINT  TAB 5;"LOW PASS ACTIVE FILTER"
502 GO SUB 800
505 PLOT 50,104
510 FOR I=1 TO 2: GO SUB 840: NEXT I
515 PLOT 90,154: GO SUB 845
520 LET X=130: LET Y=154: PLOT X,Y: GO SUB 820
525 LET X=90: LET Y=104: PLOT X,Y: GO SUB 820
530 PRINT  AT 7,7;"R1"; AT 7,12;"R3"; AT 4,7;"R2"; AT 4,18;"C2"; AT 11,7;"C1"
550 GO SUB 850: RETURN
600 PRINT  TAB 5;"HIGH PASS ACTIVE FILTER"
602 GO SUB 800
605 LET X=50: LET Y=104: PLOT X,Y: GO SUB 830
610 LET X=90: LET Y=104: PLOT X,Y: GO SUB 830
615 LET X=90: LET Y=154: PLOT X,Y: GO SUB 820
620 PLOT 90,104: GO SUB 845
625 PLOT 130,154: GO SUB 845
630 PRINT  AT 7,7;"C2"; AT 7,12;"C2"; AT 4,7;"C1"; AT 4,18;"R1"; AT 11,7;"R2"
650 GO SUB 850: RETURN
700 PRINT  TAB 5;"BAND PASS ACTIVE FILTER"
702 GO SUB 800
705 PLOT 50,104: GO SUB 840
710 PLOT 90,104: GO SUB 845
712 LET X=90: LET Y=104: PLOT X,Y: GO SUB 830
715 LET X=90: LET Y=154: PLOT X,Y: GO SUB 820
720 PLOT 130,154: GO SUB 845
730 PRINT  AT 7,7;"R1"; AT 7,12;"C1"; AT 4,7;"C2"; AT 4,18;"R3"; AT 11,7;"R2"
750 GO SUB 850: RETURN
802 DATA 18,0,0,10,0,-20,0,20,0,-10,10,0
804 DATA 11,0,1.5,4.3,-8,3.8,3.8,-8,3.8,3.8,-8,1.5,4.11,0
806 FOR N=1 TO 6: READ A(N),B(N): NEXT N
808 FOR N=1 TO 9: READ C(N),D(N): NEXT N
810 RESTORE : RETURN
820 REM VERT.CAPACITOR
822 FOR N=1 TO 6: DRAW B(N),-A(N): IF N=3 THEN  PLOT X-10,Y-22
824 NEXT N: RETURN
830 FOR N=1 TO 6: DRAW A(N),B(N): IF N=3 THEN  PLOT X+22,Y-10
834 NEXT N: RETURN
840 REM HORIZ. RESISTOR
842 FOR N=1 TO 9: DRAW C(N),D(N): NEXT N: RETURN
845 REM VERT. RESISTOR
847 FOR N=1 TO 9: DRAW D(N),-C(N): NEXT N: RETURN
850 REM COMMON CIRCUIT
851 PLOT 90,114: DRAW 0,-10
852 PLOT 130,114: DRAW 0,-10: DRAW 20,0: DRAW 0,20: DRAW 30,-30: DRAW 20,0: DRA
W -20,0: DRAW -30,-30: DRAW 0,20: DRAW -10,0: DRAW 10,0: DRAW 0,20
854 PLOT 90,154: DRAW 100,0: DRAW 0,-60: DRAW 30,0: PRINT  AT 9,28;"OUT"
855 PLOT 90,64: DRAW 0,-10: DRAW -15,0: DRAW 30,0: PLOT 85,50: DRAW 10,0: PLOT
88,46  DRAW 4,0
856 PRINT  AT 12,14;"V+/2": PRINT  AT 8,2;"IN"
860 RETURN
1000 REM  LOW PASS (CONT)
1005 LET R2=Q/(2* PI *FC*C2)
1010 LET R3=R2/(H+1)
1012 LET R1=R2/H
1015 LET C1=(1+H)*C2/(Q*Q)
1017 LET C1=C1*10^6
1018 LET C2=C2*10^6
1020 CLS
1025 GO SUB 500
1030 GO SUB 450
1032 PRINT  AT 16,15;"R3="; INT (100*R3)/100;" OHMS"
1035 GO SUB 470
1036 LET C1=C1/10^6
1037 LET C2=C2/10^6
1050 LET A=R3/R2
1052 CLS
```

```
1054 FOR N=0 TO 28
1056 LET F=10^(N/4)
1058 LET W=2* PI *F
1060 LET ZZ=W*C2*R2
1062 LET B=W*C1*R1
1064 LET R=1-ZZ*A*W*C1*R2
1066 LET I=ZZ*(1+A+A*H)
1067 LET M2=(R+B*I)*(R+B*I)+(R*B-I)*(R+B-I)
1068 LET M= SQR M2
1070 LET G=H*M/(R*R+I*I)
1071 IF II=1 THEN  RETURN
1072 IF N/4- INT (N/4)=0 THEN  GO SUB 1084
1073 IF 6+20*G/H >= 42 THEN  LET G=H*1.8
1074 PLOT 4*(2*N+5),4*(6+20*G/H)
1076 NEXT N
1077 PRINT  AT 3,11;"Z=";0
1078 PRINT  AT 2,10;"FC=";FC
1079 PRINT  AT 4,11;"H=";H
1080 PRINT  AT 0,25;"GAIN"
1081 GO TO 1090
1082 RETURN
1084 PRINT  AT 2+N/4,25; INT (1000*G)/1000
1086 PRINT  AT 21,N;"10 "
1088 PRINT  AT 20,3+N;N/4
1089 RETURN
1090 STOP : CLS : LET II=1
1092 PRINT  TAB 0;"FREQ"; TAB 10;"GAIN"; TAB 20;"DB": PRINT : PRINT
1093 FOR N=1 TO 28
1094 GO SUB 1056
1095 PRINT  TAB 0; INT (100*F)/100; TAB 10; INT (1000*G)/1000; TAB 20; INT (100*
20*.4343* LN (H/G))/100
1097 NEXT N
1098 PRINT : PRINT "FOR A NEW DESIGN, ENTER ""RUN"""
1099 STOP
2000 REM  HIGH PASS (CONT)
2005 LET R1=(2*H+1)/(4* PI *0*FC*C2)
2010 LET R2=0/( PI *FC*C2*(2+1/H))
2015 LET C1=C2/H
2020 LET C1=C1*10^6
2022 LET C2=C2*10^6
2024 CLS
2026 GO SUB 600
2028 GO SUB 450
2035 GO SUB 470
2036 LET C1=C1/10^6
2037 LET C2=C2/10^6
2040 CLS
2050 FOR N=0 TO 28
2052 LET F=10^(N/4)
2054 LET W=2* PI *F
2056 LET A=-1*W*W*C2*C2*R2
2058 LET B=W*C2
2060 LET C=1/R2-W*W*C1*C2*R1
2062 LET D=W*(C1+2*C2)
2064 LET M2=(A*C+B*D)*(A*C+B*D)+(B*C-A*D)*(B*C-A*D)
2068 LET M= SQR M2
2070 LET G(N+1)=(R1/R2)*M/(C*C+D*D)
2071 IF 6+20*G(N+1)/H >= 42 THEN  LET G(N+1)=1.8*H
2072 PLOT 4*(2*N+5),4*(6+20*G(N+1)/H)
2074 NEXT N
2076 PRINT  AT 0,2;"GAIN"
2077 PRINT  AT 3,11;"Z=";0
2078 PRINT  AT 2,10;"FC=";FC
2079 PRINT  AT 4,11;"H=";H
2080 FOR N=0 TO 28 STEP 4
2082 PRINT  AT 2+N/4,2; INT (1000*G(N+1))/1000
```

```
2084 PRINT  AT 21,N;"10 "
2086 PRINT  AT 20,3+N;N/4
2088 NEXT N
2090 STOP
2091 CLS
2092 PRINT  TAB 0;"FREQ"; TAB 10;"GAIN"; TAB 20;"DB": PRINT : PRINT
2094 FOR N=1 TO 28
2095 LET F=10^((N-1)/4)
2096 PRINT  TAB 0; INT (100*F)/100; TAB 10; INT (1000*G(N))/1000; TAB 20; INT (1
00*20*.4343* LN (H/G(N)))/100
2098 NEXT N: PRINT : PRINT "FOR A NEW DESIGN, ENTER ""RUN""": RETURN
3002 LET WC=2* PI *FC
3010 LET C1=C2*(H-Q*Q)/(Q*Q)
3012 LET R1=Q/(H*WC*C2)
3018 LET R2=1000*R1
3019 LET R3=Q*(C1+C2)/(C1*C2*WC)
3020 LET C1=C1*10^6
3022 LET C2=C2*10^6
3023 CLS
3025 GO SUB 700
3030 GO SUB 450
3035 PRINT  AT 13,0;"CENTER"
3036 PRINT  AT 14,0;"FREQ"
3037 PRINT  AT 15,0;FC;"HZ."
3038 PRINT  AT 17,0;"FILTER"
3039 PRINT  AT 18,0;"Q=";Q
3042 PRINT  AT 16,15;"R3=": INT (R3*100)/100;" OHMS"
3045 GO SUB 470
3046 LET C1=C1/10^6
3047 LET C2=C2/10^6
3050 LET GM=0
3052 FOR N=0 TO 28
3054 LET M=N+1
3055 IF Q >= 1 THEN  LET F=FC*10^(N/14-1)
3056 IF Q >= 1 THEN  GO TO 3060
3058 LET F=10^(N/4)
3060 LET W=2* PI *F
3062 LET Z1=(R1*R2)/(R1+R2)
3064 LET A=W*C1*R3
3066 LET B=1-W*W*C1*C2*R3*Z1
3068 LET C=W*Z1*(C1+C2)
3070 LET D=C*C+B*B
3072 LET DS= SQR D
3074 LET G(M)=A/DS
3076 IF G(M) >= GM THEN  LET GM=G(M)
3078 NEXT N
3079 CLS
3080 FOR N=0 TO 28
3082 LET M=N+1
3084 PLOT 4*(2*N+5),4*(9+25*G(M)/GM)
3086 NEXT N
3088 PRINT  AT 0,0;"GAIN"
3090 PRINT  AT 2,22;"FC=";FC
3092 PRINT  AT 3,22;"Q=";Q
3093 PRINT  AT 4,22;"H=";H
3094 FOR N=0 TO 28 STEP 4
3096 LET M=N+1
3098 PRINT  AT 2+N/4,0; INT (1000*G(M))/1000
3100 NEXT N
3102 IF Q >= 1 THEN  FOR N=0 TO 28 STEP 14
3103 IF Q >= 1 THEN  GO TO 3110
3109 FOR N=0 TO 28 STEP 4
3110 PRINT  AT 19,1+N;"10 "
3115 IF Q >= 1 THEN  GO TO 3126
3120 PRINT  AT 18,3+1*N;N/4
3123 PRINT  AT 21,10;"FREQUENCY"
```

```
3124 NEXT N
3125 GO TO 3131
3126 PRINT  AT 18,3+N;N/14-1
3127 PRINT  AT 21,13;"F/FC"
3130 NEXT N
3131 RETURN
3999 STOP
4000 SAVE "act.fltrs" LINE 2
```

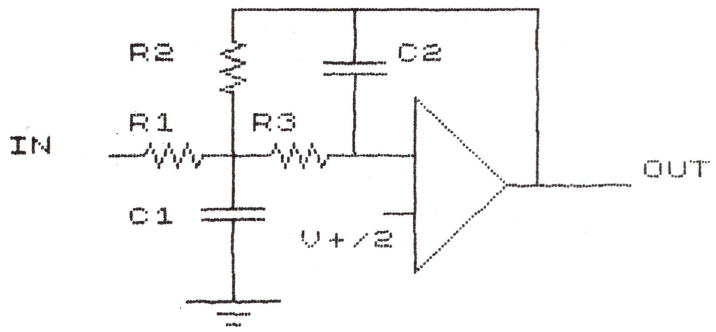
EXAMPLE LP FILTER

HP FILTER SIMILAR

BP SIMILAR LESS FINAL TABULATION

SCHEMATIC

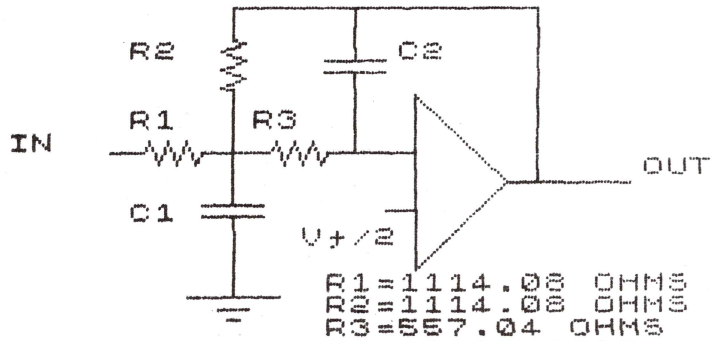
LOW PASS ACTIVE FILTER



PRESS ENTER

AFTER ENTERING C/O FREQUENCY 10000
GAIN 1
DAMPING COEF. .7

LOW PASS ACTIVE FILTER



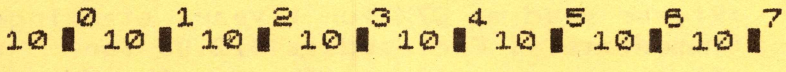

```
R1=1114.08  OHMS
R2=1114.08  OHMS
R3=557.04  OHMS
C1=.040816327  MF
C2=.01  MF
```

```
TO REDO VALUES TYPE (Y)
FOR RESPONSE, PRESS "ENTER"
```

```
                    GAIN

FC=10000            1
 Z=0.7              1
 H=1                1.007
                    1.106
                    1.906
                    .0055
                    .01
                    0
```

PLOT OF RESPONSE



TO TABULATE, CONTINUE.

FREQ	GAIN	DB
1.77	1	-.01
3.16	1	-.01
5.62	1	-.01
10	1	-.01
17.78	1.001	-.02
31.62	1.002	-.03
56.23	1.004	-.04
100	1.007	-.07
177.82	1.014	-0.13
316.22	1.026	-0.23
562.34	1.052	-0.45
1000	1.105	-0.88
1778.27	1.223	-1.76
3162.27	1.472	-3.37
5623.41	1.899	-5.58
10000	1.995	-5.81
17782.79	0.9936	0.054
31622.77	0.3563	8.97
56234.13	0.142	16.9
100000	.057	24.8
177827.94	.023	32.55
316227.76	.009	40.92
562341.32	.004	47.81
1000000	.001	55.36
1778279.4	0	62.9
3162277.7	0	70.41
5623413.3	0	77.92
10000000	0	85.43

FOR A NEW DESIGN, ENTER "RUN"

73, W4GHV & K5XY

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